



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: GUEVORKIAN et al.

SERIAL NO.: 09/872,682

EXAMINER:

FILING DATE: 6/01/01

ART UNIT:

TITLE: ARCHITECTURES FOR DISCRETE WAVELET TRANSFORMS

ATTORNEY DOCKET NO.: 456-010393-US (PAR)

The Commissioner of Patents

Washington, D.C. 20231

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INFORMATION DISCLOSURE STATEMENT

Dear Sir:

The following information is being disclosed to the Patent and Trademark Office as information that may be material to the examination of the above-identified patent application.

This Information Disclosure Statement is being filed before receipt of a first Office Action on the above-identified patent application. Thus, a certification under 37 CFR 1.97 (e) or fee under 37 CFR 1.17 (p) is not required for the information herein to be considered.

Applicants' attorney encloses copies of the following list of documents, which were cited on pp. 38, 39, and 40, of the specification of the above-identified patent application.

1. "A Theory for Multiresolution Signal Decomposition: The Wavelet Representation," Mallat, IEEE Trans. on Pattern

- Analysis and Machine Intelligence, Vol. 2, No. 12, 1989, pp. 674-693.
2. "Wavelets and Subband Coding," Vetterli et al., Prentice Hall, 1995, relevant pages thereof.
  3. "Ten Lectures on Wavelets," Daubechies, Society for Industrial and Applied Mathematics, 1992, relevant pages thereof.
  4. "The Wavelet Transform, Time Frequency, Localization and Signal Analysis," Daubechies, IEEE Trans. on Information Theory, vol. 36, No. 5, 1990, pp. 961-1005.
  6. "Fast Wavelet Transforms and Numerical Algorithms I," Beylkin et al., Yale Univ., 1989, pp. 1-41.
  7. "Interictal EEG Spike Detection: A New Framework Based on The Wavelet Transform," Senhadji et al., Proc. IEEE-SP Int. Symp. Time-Frequency Time-Scale Anal., 1994, pp.548-551.
  8. "Multifrequency Channel Decompositions of Images and Wavelet Models," Mallat, IEEE Trans. on Acoust., Speech and Signal Processing, vol. 37, No. 12, 1989, pp. 2091-2110.
  9. "Short-Length FIR Filters and Their Use in Fast Nonrecursive Filtering," Mou et al., IEEE Trans. on Signal Processing, Vol. 39, No. 6, 1991, pp. 1322-1332.
  12. "New Systolic Arrays for Computation of the 1-D Discrete Wavelet Transform," Pan et al., Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing, 1997, Vol. 5, 1997, pp. 4113-4116.
  13. "An Efficient VLSI Architecture for the Computation of 1-D Discrete Wavelet Transform," Premkumar et al., Proc. of the IEEE Int. Conf. On Information, Communications and Signal Processing, 1997, pp. 1180-1184.

14. "VLSI Architectures for the Discrete Wavelet Transform," Vishwanath et al., IEEE Trans. on Circuits and Systems II: Analog and Digital Signal Processing, vol. 42, No. 5, 1995, pp.305-316.
15. "Discrete Wavelet Transform: Data Dependence Analysis and Synthesis of Distributed Memory and Control Array Architectures," Fridman et al., IEEE Trans. on Signal Processing, vol. 45, n. 5, 1997, pp. 1291-1308.
16. "VLSI Architectures for Discrete Wavelet Transforms," Parhi et al., IEEE Trans. on VLSI Systems, vol. 1, No. 2, 1993, pp. 191-202.
17. "Systolic VLSI Architectures for 1-D Discrete Wavelet Transforms," Denk et al., Proceedings of the Thirty-Second Asilomar Conference on Signals, Systems & Computers, 1998, vol. 2 pp. 1220-1224.
18. "VLSI Architecture for the Discrete Wavelet Transform," Knowles, Electronics Letters, vol. 26, No. 15, 1990, pp. 1184-1185.
19. "Efficient Realizations of Discrete and Continuous Wavelet Transforms: From Single Chip Implementations to Mappings on SIMD Array Computers," Chakrabarti et al., IEEE Trans. on Signal Processing, vol. 43, No. 3, 1995, pp. 759-771.
20. "Architectures for Wavelet Transforms: A Survey," Chakrabarti et al., Journal of Signal Processing, Vol. 14, No. 2, 1996.
21. "VLSI Implementation of Discrete Wavelet Transform," Grzeszczak et al., IEEE Trans. on VLSI Systems, vol. 4, No. 4, 1996, pp. 421-433.
22. "A Common Architecture for the DWT and IDWT," Vishwanath et al., Proceedings of IEEE Int. Conf. on

Application Specific Systems, Architectures and Processors, 1996, pp. 193-198.

23. "Design and Implementation of a Highly Efficient VLSI Architecture for Discrete Wavelet Transform," Yu et al., Proceedings of IEEE Int. Conf. on Custom Integrated Circuits, 1997, pp. 237-240.
24. "A Scalable Architecture for Discrete Wavelet Transform," Syed et al., Proceedings of Computer Architectures for Machine Perception (CAMP '95), 1995, pp. 44 -50.
26. "The Recursive Pyramid Algorithm for the Discrete Wavelet Transform," Vishwanath, IEEE Transactions on Signal Processing, vol. 42, No. 3, 1994, pp. 673-677.
27. "Trading Speed for Low Power by Choice of Supply and Threshold Voltages," Liu et al., IEEE Journal of Solid State Circuits, vol. 28, No. 1, 1993, pp. 10-17.
30. "High-Speed/Low-Power 1-D DWT Architectures With High Efficiency," Marino et al., Proceedings of the IEEE International Conference on Circuits and Systems, 2000, vol. 5, pp. 337-340.
31. "Computational Aspects of Discrete Linear Transforms and Rank Order Based Filters", D.Z. Gevorkian, Thesis for the degree of Doctor of Technology, 1997, relevant pages.
32. "Parallel Algorithms and Architectures for a Family of Haar-like Transforms," Astola et al., Proceedings of SPIE's International Symposium on Electronic Imaging: Science and Technology, vol. 2421, 1995.
34. Eusipco 2000 CD-ROM Proceedings, "Highly Efficient Fast Architectures for Discrete Wavelet Transforms Based on Their Flowgraph Representation", Gevorkian et al., X European Signal Processing Conference, 2000.



36. "TMS320C6000<sup>tm</sup> Highest Performance DSP Platform," 3 page document.
37. "Architectures for Digital Signal Processing," P. Pirsch, J. Willey & Sons, 1998, relevant pages thereof.

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Copies of the cited references are enclosed together with PTO-Form 1449.

Respectfully submitted,

Clarence A. Green Reg. No.: 24,622

PERMAN & GREEN, LLP

425 Post Road, Fairfield, CT 06430

(203) 259-1800

Customer No.: 2512

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#### CERTIFICATE OF MAILING

I hereby certify that the attached Information Disclosure Statement, PTO-Form 1449 and references are being deposited with the United States Postal Service as first class mail on the date shown below in an envelope addressed to: Commissioner of Patents, Washington, D.C. 20231.

November 1, 2001  
Date

Deborah J. Clark  
Name of Person Making Deposit

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(Substitute)

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**FOREIGN PATENT DOCUMENTS**

Initials	Document Number	Date	Country	Name	Translation? Yes/No/n/a

**OTHER DOCUMENTS (Title, Author, Date, Pages, Etc., if known)**

	"A Theory for Multiresolution Signal Decomposition: The Wavelet Representation," Mallat, IEEE Trans. on Pattern Analysis and Machine Intelligence, Vol. 2, No. 12, 1989, pp. 674-693.
	"Wavelets and Subband Coding," Vetterli et al., Prentice Hall, 1995, relevant pages thereof.
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	"VLSI Architectures for the Discrete Wavelet Transform," Vishwanath et al., IEEE Trans. on Circuits and Systems II: Analog and Digital Signal Processing, vol. 42, No. 5, 1995, pp.305-316.
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	"VLSI Architectures for Discrete Wavelet Transforms," Parhi et al., IEEE Trans. on VLSI Systems, vol. 1, No. 2, 1993, pp. 191-202.
	"Systolic VLSI Architectures for 1-D Discrete Wavelet Transforms," Denk et al., Proceedings of the Thirty-Second Asilomar Conference on Signals, Systems & Computers, 1998, vol. 2 pp. 1220-1224.
	"VLSI Architecture for the Discrete Wavelet Transform," Knowles, Electronics Letters, vol. 26, No. 15, 1990, pp. 1184-1185.

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	"VLSI Implementation of Discrete Wavelet Transform," Grzeszczak et al., IEEE Trans. on VLSI Systems, vol. 4, No. 4, 1996, pp. 421-433.
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	"Computational Aspects of Discrete Linear Transforms and Rank Order Based Filters", D.Z. Gevorkian, Thesis for the degree of Doctor of Technology, 1997, relevant pages.
	"Parallel Algorithms and Architectures for a Family of Haar-like Transforms," Astola et al., Proceedings of SPIE's International Symposium on Electronic Imaging: Science and Technology, vol. 2421, 1995.
	Eusipco 2000 CD-ROM Proceedings, "Highly Efficient Fast Architectures for Discrete Wavelet Transforms Based on Their Flowgraph Representation", Gevorkian et al., X European Signal Processing Conference, 2000.
	"TMS320C6000 <sup>tm</sup> Highest Performance DSP Platform," 3 page document.
	"Architectures for Digital Signal Processing," P. Pirsch, J. Willey & Sons, 1998, relevant pages thereof.

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